Draft - June 25, 1993

San Juan Islands Geographic Response Plan Workshop
Data Recording Sheet

Resource: Pacific Salmon - chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), sockeye (*O. nerka*), chum (*O. keta*), and pink (*O. gorbuscha*).

Resource Information Mapped: None

Resource Use: Human; extensive commercial and recreational fisheries. Non-human; the list of predators on the various life history stages of salmon is extensive and includes several species of birds (bald eagle), fish, marine mammals, and terrestrial mammals.

General Location or Habitat Association of Resource: Salmon spawn and rear in all major Washington watersheds and in many of the smaller tributaries. Salmon are anadromous in that they begin life in fresh water, spend the largest portion of their life in salt water, then return to fresh water to spawn. There is a broad range of life history types both between and within the species. Both juvenile and adult salmon are present year round throughout this region.

Seasonal Sensitivity: Varies with species, stock, and river system. See habitat association and timing table.

Recommended Protection Strategy: In the estuaries contain and recover oil in the main channels as close to the entrances as possible or divert to shore based recovery points. Keep oil off of the intertidal flats. Where oil cannot be excluded from the beach use clean up techniques which do not force oil into beach substratum or transport it into the lower intertidal or subtidal zones. Along the coast boom the river and stream mouths.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

References:

Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries; Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 p.

Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

San Juan Islands Baitfish Resources

Smelt Spawning
Sand Lance Larvae
Herring Spawning
Herring Holding
USGS Shoreline

Meters
0 5000 10000

Source: Washington Department of Fisheries
This map does not offer complete information on fish and shellfish resource distribution. Comprehensive surveys have not been completed in all areas.

Draft - June 7, 1993

San Juan Islands Geographic Response Plan Workshop
Data Recording Sheet

Resource: Rockfish (Sebastes spp.)

Resource Information Mapped: Critical juvenile (young-of-the-year) rockfish habitat.

Resource Use: Human - rockfish are an important commercial and recreational species complex. Non-human - Rockfish are utilized as food organisms by various marine fish species including lingcod and by marine mammals.

General Location or Habitat Association of Resource: High densities of juvenile rockfish are found in nearshore eelgrass and kelp beds. In kelp beds fish are often found within 50 cm of the surface. These habitats are critical to their survival, providing protective cover as well as food. All the eelgrass and kelp beds within the region may provide juvenile habitat. Areas of particular interest include the kelp beds along the northern shore of Cliff Island, the south shore of James Island and between Canoe Island Picnic Point.

Seasonal Sensitivity: High densities of juvenile rockfish are found in the eelgrass and kelp beds from June through September.

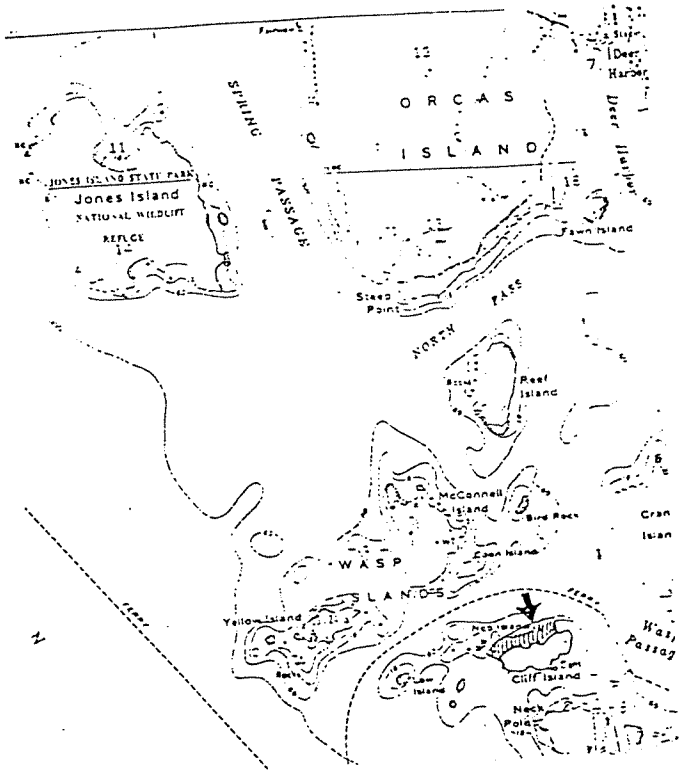
Recommended Protection Strategy: Prevent oil from entering or penetrating into the kelp and eelgrass beds. The beds mentioned above are a high priority for protection. They are small enough that exclusion or deflection booming may protect them.

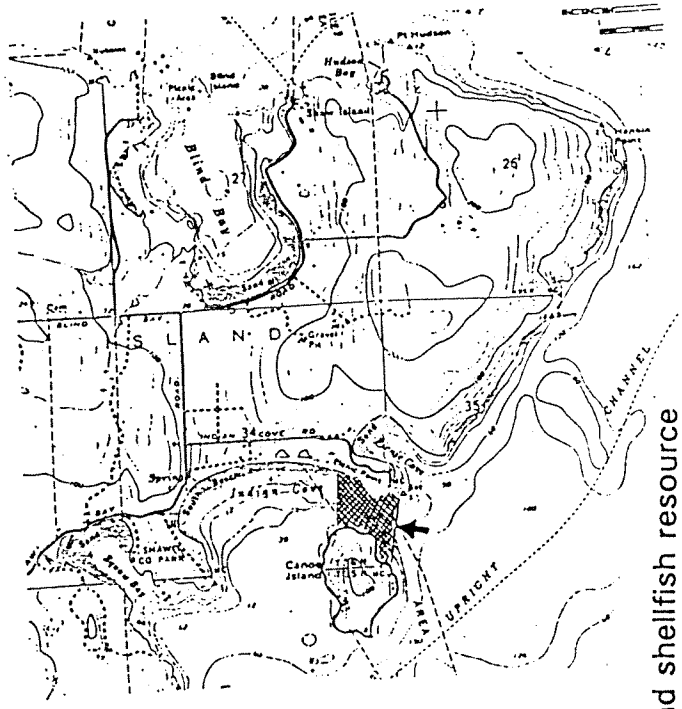
Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit and Marine Habitat Investigations Unit

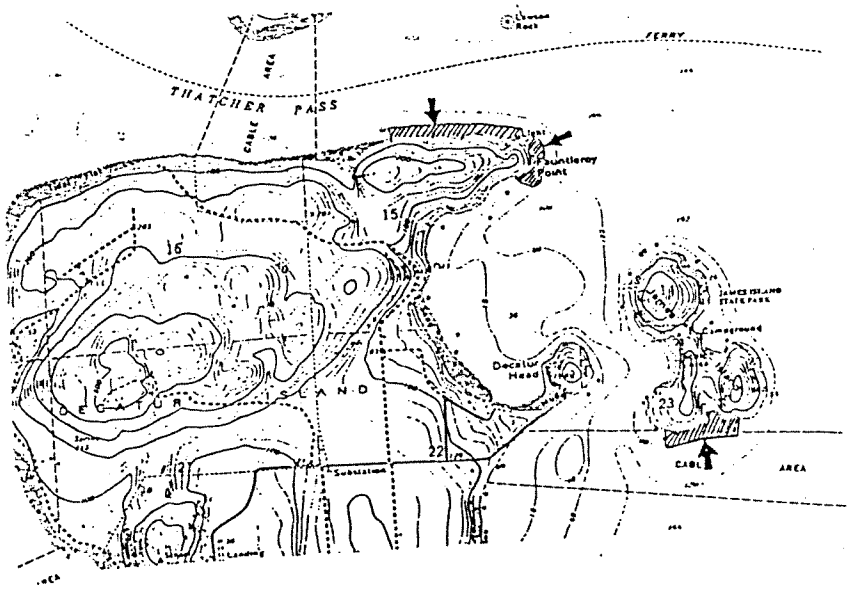
References:

Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

San Juan Islands Fish Resources







Juvenile Rockfish Rearing

Source: Washington Department of Fisheries
This map does not offer complete information on fish and shellfish resource distribution. Comprehensive inventories have not been completed along all shorelines

Draft - June 7, 1993

San Juan Island Geographic Response Plan Workshop
Data Recording Sheet

Resource: Pacific Herring (*Clupea harengus pallasi*)

Resource Information Mapped: Adult prespawning holding areas and spawning areas.

Resource Use: Human; Strait of Georgia sac-roe and roe-on-kelp fisheries, sport bait fishery targets juvenile fish. Non-human; one of the most important components of the marine food chain; they provide the link between primary production and upper level predators. All life history stages utilized as food by various predators including salmon, rockfish, lingcod, halibut, birds, marine mammals, etc.

General Location or Habitat Association: An adult prespawning holding area is located in Harney Channel. Fish are found in pelagic schools. In this region herring spawning occurs in Mud Bay, Hunter Bay, Shoal Bay, Blind Bay, East Sound, West Sound, Westcott Bay, Garrison Bay and Roche Harbor. Herring deposit their eggs on marine vegetation, such as eel grass or algae, within the shallow subtidal and intertidal zones.

Seasonal Sensitivity or Occurrence: Adult herring congregate in relatively distinct areas from December through June prior to and after spawning. Exposure of pre-spawning adults to oil can result in the accumulation of hydrocarbon compounds in the yolk of maturing eggs. Metabolism of these compounds during embryonic and larval stages can result in lethal and sublethal genetic, cellular and morphological injuries. Spawning occurs from January through mid-April in the San Juan Islands. Eggs hatch after approximately 10 days. Larvae and subsequent juvenile fish are found in nearshore areas throughout the following summer. Eggs and larvae are highly susceptible to injury (lethal) from oil exposure.

Recommended Protection Strategy: Utilize booming and aggressive open water collection techniques to keep oil off of the spawning substrate throughout the region.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

References:

Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries; Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 p.

Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

San Juan Islands Baitfish Resources

Source: Washington Department of Fisheries
This map does not offer complete information on fish and shellfish resource distribution.
Comprehensive inventories have not been completed in all areas.

Herring Spawning

Herring Holding

USGS Shoreline

Meters
0 5000 10000

Draft - June 7, 1993

San Juan Islands Geographic Response Plan Workshop
Data Recording Sheet

Resource: Surf Smelt (*Hypomesus pretiosus*)

Resource Information Mapped: Intertidal surf smelt spawning areas.

Resource Use: Human - commercial and recreational harvest. Non-human - important component of the marine food chain; smelt provide the link between primary production and upper level predators. All life history stages are utilized as food by various predators including salmon, rockfish, lingcod, halibut, birds, marine mammals, etc.

General Location of Sensitive Resource: Surf smelt deposit their eggs in the uppermost intertidal zone on gravel generally having a grain size from 1 to 7 mm. Incubation takes 2 - 4 weeks. Larvae are found in adjacent nearshore surface waters for several weeks following hatching. Documented spawning areas Hunter Bay, Mud Bay, White Cliff, Thatcher Bay, Shoal Bay, Blind Bay, and East Sound. Other undocumented spawning areas are suspected in the region.

Seasonal Sensitivity or Occurrence: Surf smelt spawning in the San Juans occurs year around. Eggs and larvae are highly susceptible to injury (lethal) from oil exposure.

Recommended Protection Strategy: Keep oil off of spawning beaches regardless of season. Utilize protective booming where possible and aggressive open water collection techniques elsewhere.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

References:

Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries; Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 p.

Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

San Juan Islands Baitfish Resources

Source: Washington Department of Fisheries
This map does not offer complete information on fish and shellfish resource distribution. Comprehensive inventories have not been completed in all areas.

Draft - June 7, 1993

San Juan Islands Geographic Response Plan Workshop
Data Recording Sheet

Resource: Pacific Sand Lance (*Ammodytes hexapterus*)

Resource Information Mapped: Documented intertidal spawning areas and larval rearing areas.

Resource Use: Human - sand lance are used as bait by recreation fishers. Non-human - important component of the marine food chain; sand lance provide the link between primary production and upper level predators. All life history stages are utilized as food by various predators including salmon, rockfish, lingcod, halibut, birds, marine mammals, etc.

General Location or Habitat Association of Resource: Pacific sand lance spawn from November through February and deposit their eggs on upper intertidal sandy-gravel beaches. No spawning areas have been documented in the region. However, the presence of sand lance larvae indicates spawning does occur in the region. Sand lance larvae are widespread in the regions near-surface waters from January through March. It is suspected that additional spawning and larval habitat exists within the region. Adult sand lance are found in nearshore habitats throughout the region.

Seasonal Sensitivity: The highest sensitivity is during the spawning and larval stages from October through March. Eggs and larvae are highly susceptible to injury (lethal) from oil exposure.

Recommended Protection Strategy: Keep oil off of spawning beaches regardless of season. Utilize protective booming where possible and aggressive open water collection techniques elsewhere.

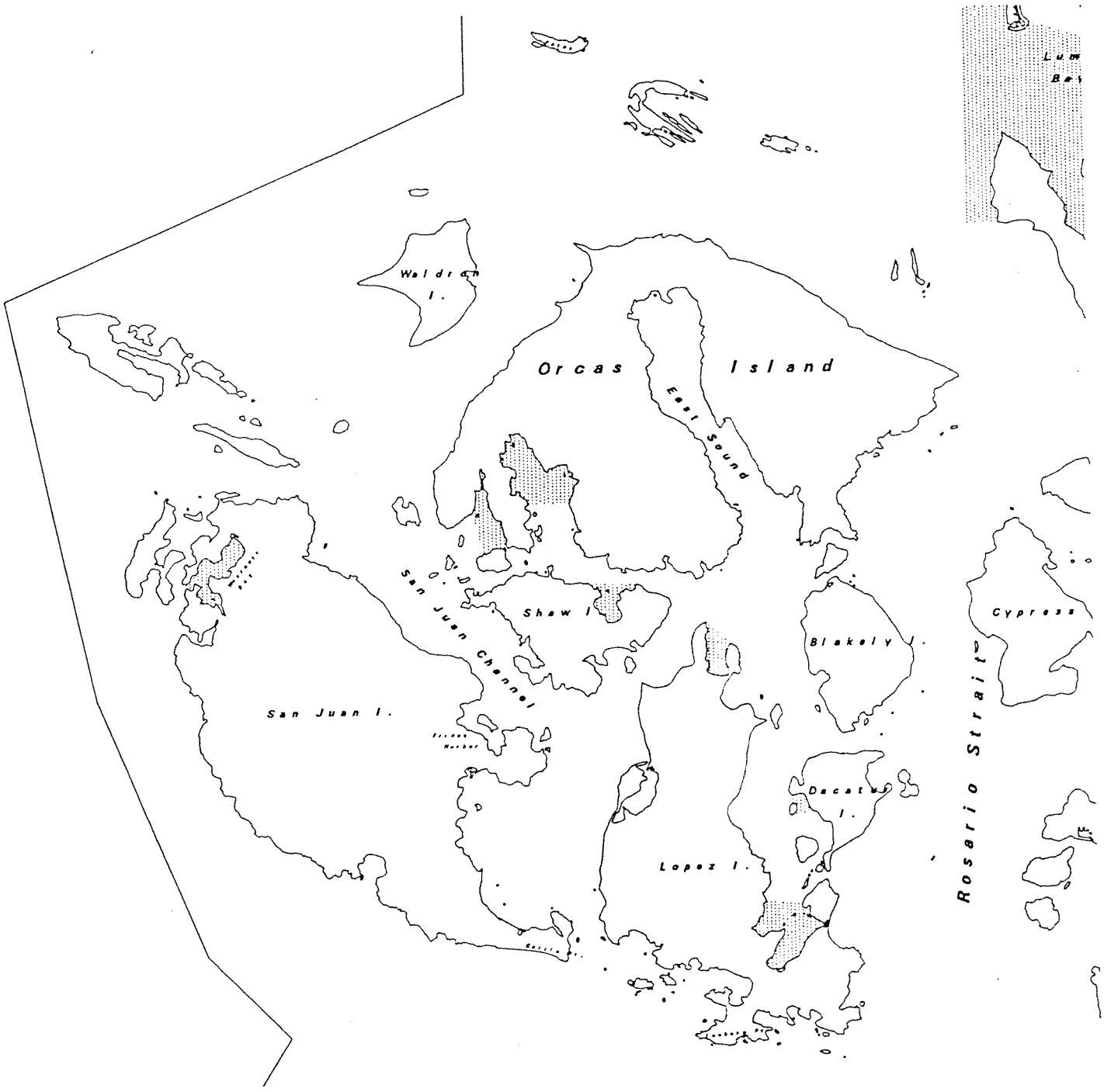
Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

References:

Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries; Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 p.

Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

San Juan Islands Baitfish Resources



Sand Lance Larvae

USGS Shoreline

Meters

0 5000 10000

Source: Washington Department of Fisheries
This map does not offer complete information on fish and shellfish resource distribution. Comprehensive inventories have not been completed in all areas.

December 6, 1994

Draft - June 7, 1993

San Juan Islands Geographic Response Plan Workshop
Data Recording Sheet

Resource: Cancer Crab

Resource Information Mapped: Dungeness (*Cancer magister*) and red rock (*C. productus*) crab distribution. Map depicts primarily adults but does cover some juvenile areas. Important juvenile habitat will correlate with the herring spawning (eelgrass) and oyster areas (see appropriate maps).

Resource Use: Human - large commercial and recreational harvest. Non-human - all life history phases are utilized as food by numerous fish species (eg. Pacific herring, lingcod, rockfish, coho and chinook salmon, halibut, English sole and cabezon), octopus, sea otters, harbor seals, sea lions, and gulls.

General Location or Habitat Association of Resource: Cancer crab are found in Lopez Sound, Shoal Bay, Blind Bay, Indian Cove, Buck Bay, East Sound, West Sound, Deer Harbor, False Bay, Westcott Bay Garrison Bay, Roche Harbor, Reid harbor, Cowlitz Bay, and around Sucia Island. Adults are found from the intertidal to -90 m MLLW and prefer sandy substrates. Juveniles are found intertidally and typically associated with eelgrass, ulva, bivalve shells, or some form of cover, from +3 to -15 m MLLW. Larvae and megalopae are planktonic. Megalopae are typically found in nearshore waters where they settle to the bottom and metamorphose into juveniles during summer. Females carry incubating eggs beginning in the fall and hatching occurs between February and April.

Seasonal Sensitivity: Larvae/megalopae - planktonic - March through July. Juveniles - epibenthic intertidal - year-round.

Recommended Protection Strategy: Protect nearshore juvenile habitat, particularly eelgrass beds. Utilize protective booming where possible and aggressive open water collection techniques elsewhere.

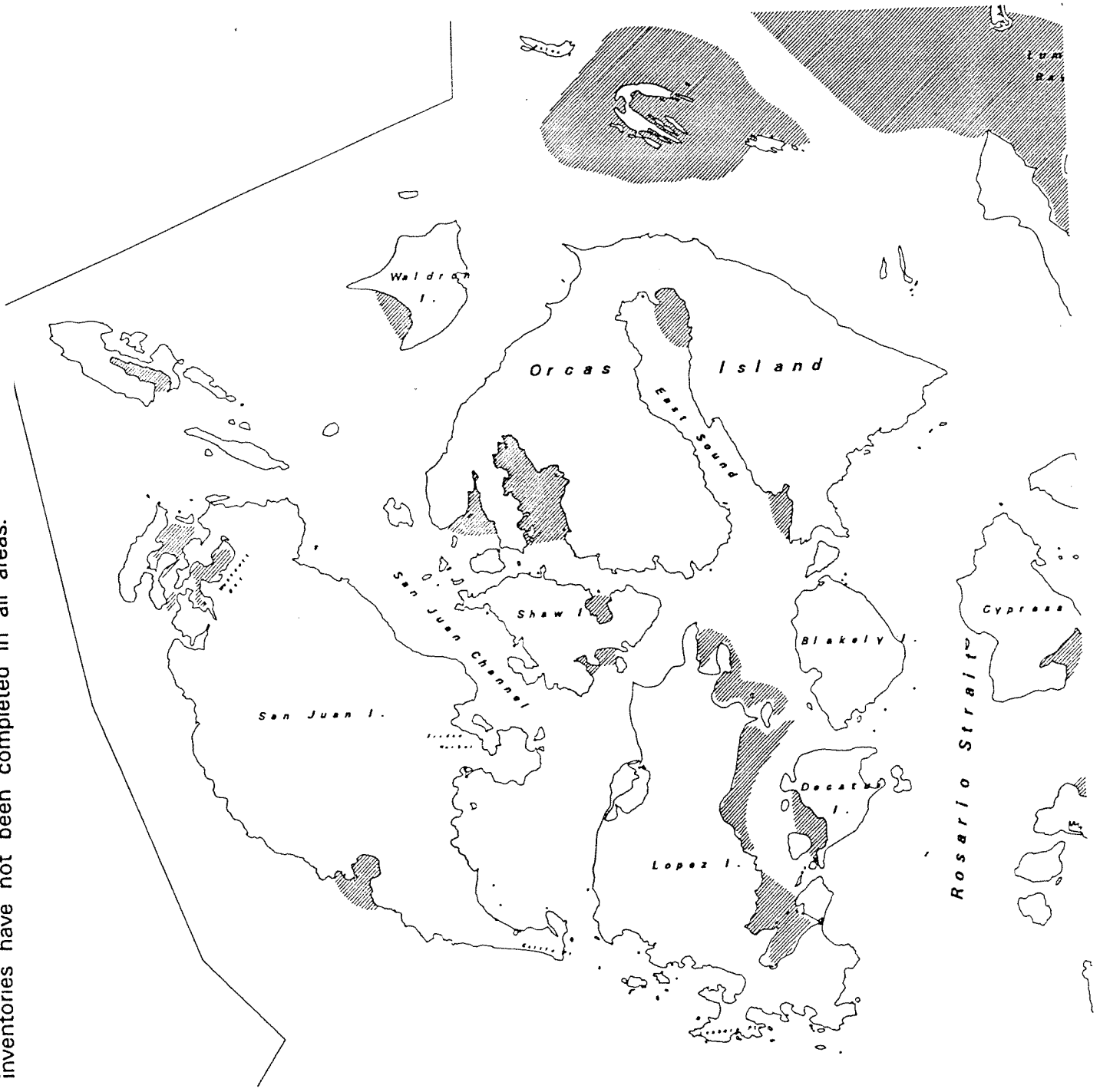
Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

References:

Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries; Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 p.

Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

San Juan Islands Shellfish Resources



Dungeness Crab

USGS Shoreline

Source: Washington Department of Fisheries
This map does not offer complete information on fish and shellfish resource distribution. Comprehensive inventories have not been completed in all areas.

Draft - June 7, 1993

San Juan Islands Geographic Response Plan Workshop Data Recording Sheet

Resource: Intertidal and subtidal hardshell clams, and intertidal softshell clams.

Resource Information Mapped: Hardshell intertidal include the native littleneck (*Protothaca staminea*), the Manila littleneck (*Tapes philippinarum*), butter clams (*Saxidomus giganteus*), piddock clams (*Zirfaea pilsbryi*), and horse clams (*Tresus capax* and *T. nuttallii*), and cockles (*Clinocardium nuttali*). Subtidal includes butter clams, piddock clams and horse clams. Softshell intertidal includes only the eastern softshell clam (*Mya arenaria*).

Resource Use: Human; commercial and recreational harvest. Non human; as a group clams are feed upon by a wide variety of organisms including snails, sea stars, Dungeness and rock crabs, several species of commercially and recreationally import fish, sea otters, raccoons, scoters and other birds.

General Location or Habitat Association of Resource: Clams are found throughout the region. Concentrations of intertidal hardshell clams are located in Lopez Sound (Spencer Spit), East Sound, Westcott Bay, and Reid Harbor. Clams are found from approximately +2 m MLLW in the intertidal zone to subtidal depths of -21 m MLLW.

Seasonal Sensitivity: Due to their sessile lifestyle in the intertidal zone clams are at high risk of exposure throughout the year. Sensitivity would be elevated during the spawning and larval period which can extend from April through October.

Recommended Protection Strategy: Utilize protective booming where possible and aggressive open water collection techniques elsewhere. Where oil cannot be excluded from the beach use clean up techniques which do not force oil into beach substratum.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

References:

Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries; Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 p.

Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

San Juan Islands Shellfish Resources

Source: Washington Department of Fisheries
This map does not offer complete information on fish and shellfish resource distribution.
Comprehensive inventories have not been completed in all areas.

Draft - June 7, 1993

San Juan Islands Geographic Response Plan Workshop
Data Recording Sheet

Resource: Sea Urchin

Resource Information Mapped: Commercial quantities of adult sea urchins, primarily the red sea urchin (*Strongylocentrotus franciscanus*).

Resource Use: Human - commercial fishery. Non-human - dominant organism in rocky nearshore communities, responsible for shaping the character of the habitat through their grazing activities. Important prey item for wolf eels and sea otters.

General Location or Habitat Association of Resource: Sea urchins populate the kelp beds throughout the region. Urchins are found from the lower intertidal to depths of 125 m but the highest densities are found at depths less than 30 m. Juveniles are found in adult habitat and require the adults presence to survive.

Seasonal Sensitivity: Spawning occurs during the spring followed by a planktonic larval phase that lasts from 60 to 130 days. Adults are susceptible to oil exposure via ingestion of contaminated marine algae, particularly kelp. Highest risk of this type of exposure is from April to November.

Recommended Protection Strategy: Prevent oil from contaminating nearshore kelp beds. Utilize beach clean up techniques that do not transport oil into shallow subtidal area.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

References:

Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

San Juan Islands Shellfish Resources

Urchin

USGS Shoreline

Meters

0 6000 12000

Source: Washington Department of Fisheries
This map does not offer complete information on fish and shellfish resource distribution. Comprehensive inventories have not been completed in all areas.

Draft - June 7, 1993

San Juan Islands Geographic Response Plan Workshop
Data Recording Sheet

Resource: Pandalid Shrimp

Resource Information Mapped: Harvest areas for four species of shrimp including; pink (*Pandalus jordani* and *P. borealis*), coonstripe (*P. danae*), and spot prawn (*P. platyceros*).

Resource Use: Human - commercial and recreational fisheries. Non-human - food organism for many fish species including rockfish, cabezon, and perch.

General Location or Habitat Association of Resource: Most harvest occurs in waters 100 to 220 m deep, however, the coonstripe and spot prawn are found as shallow as the lower intertidal zone. Commercially harvestable concentrations of pandalid shrimp are found in San Juan Channel, Harney Channel, and Lopez Sound.

Seasonal Sensitivity: Planktonic larval phase from February through July.

Recommended Protection Strategy: Utilize beach clean up techniques that do not transport oil into shallow subtidal area.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

References:

Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

Hueckel, G.J. 1980. Foraging on an artificial reef by three Puget Sound fish species. Wa. Dept. Fish. Tech. Rpt. 53. 110 p.

San Juan Islands Shellfish Resources

Pandalid Shrimp

USGS Shoreline

Meters

0 6000 12000

Source: Washington Department of Fisheries
This map does not offer complete information on fish and shellfish resource distribution. Comprehensive inventories have not been completed in all areas.

Draft - June 7, 1993

San Juan Islands Geographic Response Plan Workshop
Data Recording Sheet

Resource: Northern Abalone (*Haliotis kamtschatkana*)

Resource Information Mapped: Documented areas of abalone presence.

Resource Use: Human - recreational fishery only. Non-human - important prey item for sea otters, octopus, and cabezon.

General Location or Habitat Association of Resource: Abalone are found along exposed or semi-exposed bedrock or boulder shorelines from the intertidal zone to depths of 20 m. Within this region they are found along the outer shorelines of Lopez, San Juan, Stuart, Waldron, Sucia, and Patos Islands.

Seasonal Sensitivity: Adult abalone congregate in the shallow subtidal zone to spawn from April through June. Abalone broadcast eggs and sperm into the water column and fertilized eggs sink to the bottom and hatch within days. Larvae spend 5 to 6 days as free swimmers in the water column. Adults are susceptible to oil exposure via ingestion of contaminated marine algae, particularly kelp. Highest risk of this type of exposure is from April to November.

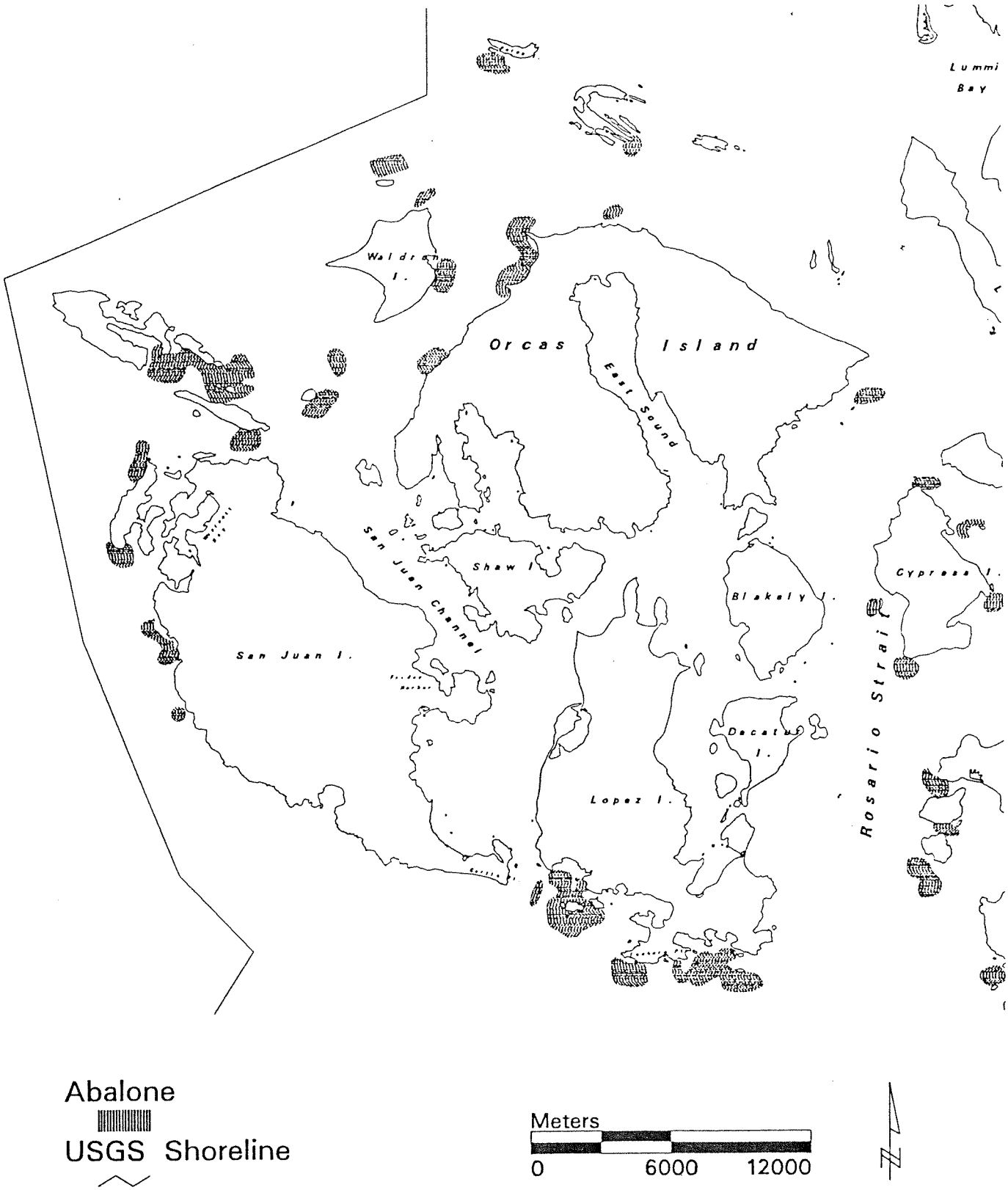
Recommended Protection Strategy: Prevent oil from contaminating nearshore kelp beds. Utilize beach clean up techniques that do not transport oil into shallow subtidal area.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

References:

Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

San Juan Islands Shellfish Resources



Source: Washington Department of Fisheries
This map does not offer complete information on fish and shellfish resource distribution.
Comprehensive inventories have not been completed in all areas.

Draft - June 7, 1993

San Juan Islands Geographic Response Plan Workshop
Data Recording Sheet

Resource: Geoduck Clams (*Panope abrupta*)

Resource Information Mapped: Geoduck clam distribution (commercial quantities).

Resource Use: Human; Geoducks support a large commercial and recreational fisheries. Non human; Geoducks are fed upon by snails, pandalid shrimp, rock crab, English sole, sand sole, rock sole, starry flounder, starfish, and sea otters.

General Location or Habitat Association of Resource: Geoducks are found northeast of Humphrey Head (Lopez Is.) and north of Rock Point (Lopez Is.). They inhabit depths from +1 to -110 m MLLW. Preferred substrate is stable mud and sand.

Seasonal Sensitivity: Sensitivity would be highest during the spawning and larval period from April through August (peak May - July).

Recommended Protection Strategy: Utilize beach clean up techniques which do not transport oil into the subtidal zone.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

References:

Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries; Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 p.

Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

San Juan Islands Shellfish Resources

Source: Washington Department of Fisheries
This map does not offer complete information on fish and shellfish resource distribution.
Comprehensive inventories have not been completed in all areas.

Draft - June 7, 1993

San Juan Islands Geographic Response Plan Workshop
Data Recording Sheet

Resource: Octopus (*Octopus dofleini*)

Resource Information Mapped: Documented octopus habitat.

Resource Use: Harvested in commercial, recreational, and subsistence fisheries.

General Location or Habitat Association of Resource: Octopus live in caves or dens from the lower intertidal to the subtidal zones.

Seasonal Sensitivity: The portion of the population inhabiting the lower intertidal and shallow subtidal zone would be subject to exposure during extreme low tides throughout the year. Octopus are also susceptible to exposure via contaminated prey, particularly clams and crab.

Recommended Protection Strategy: Utilize beach clean up techniques that do not transport oil into shallow subtidal area.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

References:

Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

San Juan Islands Shellfish Resources

Source: Washington Department of Fisheries
This map does not offer complete information on fish and shellfish resource distribution.
Comprehensive inventories have not been completed in all areas.

Draft - June 7, 1993

San Juan Islands Geographic Response Plan Workshop
Data Recording Sheet

Resource: Pacific Oyster (*Crassostrea gigas*)

Resource Information Mapped: Oyster beds, primarily cultured.

Resource Use: Human - recreational and commercial harvest. Non-human - Oyster beds provide important habitat for juvenile dungeness crab. Juvenile and adult oysters are preyed upon by dungeness and red rock crab, several starfish species, and surf and white-winged scoters.

General Location or Habitat Association of Resource: Pacific oysters are found in the lower intertidal and shallow subtidal zones in Westcott Bay.

Seasonal Sensitivity: Due to their sessile lifestyle in the intertidal zone oysters are at high risk of exposure throughout the year. Relative to their habitat function for juvenile dungeness crab the most sensitive period would be June through December.

Recommended Protection Strategy: Utilize protective booming where possible and aggressive open water collection techniques elsewhere.

Information Recorder: WDF - Oil Spill Response and Damage Prevention Unit

References:

Emmett, R.L., S.L. Stone, S.A. Hinton, and M.E. Monaco. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries; Volume II: species life history summaries. ELMR Rep. No. 8. NOAA/NOS Strategic Environmental Assessments Division, Rockville, MD, 329 p.

Washington Department of Fisheries. 1992. Salmon, marine fish and shellfish resources and associated fisheries in Washington's coastal and inland marine waters. Wa. Dept. Fish. Tech. Rpt. 79. 70 p.

San Juan Islands Shellfish Resources

Source: Washington Department of Fisheries
This map does not offer complete information on fish and shellfish resource distribution. Comprehensive inventories have not been completed in all areas.

Puget Sound Fish and Shellfish Habitat Association Table - Key

Life Stages - eggs
larvae
juveniles
spawners/spawning
parturition (birth)
adults

Timing - --- common
+++ abundant
*** highly abundant

Salinity Range -

tidal fresh	0.0 - 0.5	ppt
mixing	0.5 - 25.0	ppt
seawater	>25.0	ppt

Habitats -

intertidal	0-3 m
subtidal	3-10m

Data Source - Monaco, M.E. et al. 1990. Distribution and abundance of fishes and invertebrates in west coast estuaries. Vol. I: Data summaries. ELMR Rept. 4. Strategic Assessment Branch, NOS/NOAA, Rockville, MD

Emmett, R.L. et al. 1991. Distribution and abundance of fishes and invertebrates in west coast estuaries. Vol. II: Species Life History Summaries. ELMR Rept. 8. Strategic Assessment Branch, NOS/NOAA, Rockville, MD

6-94

December 6, 1994

SAN JUAN ISLANDS/ NORTH PUGET SOUND GRP

DRAFT

Fish Habitat Association in Puget Sound

Species	Timing	Salinity Range			Substrate Preference									Habitats						
														Type			Area			
		Tidal Fresh	Mixing	Seawater	Mud/Silt/Clay	Sand/Granule	Pebble	Cobble	Boulder/Riprap	Rocky Outcrop	Estuarine Veg	Marine Veg	None	Benthic Intertidal	Benthic Subtidal	Pelagic	Mainstem Channel	Subsidiary Channel	Channel Edge	Intertidal Flat
Spring Chinook Salmon	J F M A M J J A S O N D																			
juveniles	------++++++++++++++++---	X	X	X		X	X	X								X	X	X	X	X
adults	--++++++++++--	X	X	X		X	X	X								X	X	X	X	X
Fall Chinook Salmon	J F M A M J J A S O N D																			
juveniles	--------++++++++++++-----	X	X	X		X	X	X								X	X	X	X	X
adults	------++++++---	X	X	X		X	X	X								X	X	X	X	X
Sockeye Salmon	J F M A M J J A S O N D																			
juveniles	----++------	X	X	X									X			X	X	X	X	X
adults	--++++----	X	X	X		X	X									X	X	X	X	X
Coho Salmon	J F M A M J J A S O N D																			
juveniles	----++++--------	X	X	X		X	X									X	X	X	X	X
adults	---- ----++++-	X	X	X		X	X									X	X	X	X	X
Chum Salmon	J F M A M J J A S O N D																			
juveniles	--++++**++----------	X	X	X									X			X	X	X	X	X
adults	++------ --++*****+	X	X	X		X	X									X	X	X	X	X

Fish Habitat Association in Puget Sound (cont.)

Species	Timing	Salinity Range			Substrate Preference									Habitats: Type			Habitats: Area			
		Tidal Fresh	Mixing	Seawater	Mud/Silt/Clay	Sand/Granule	Pebble	Cobble	Boulder/Riprap	Rocky Outcrop	Estuarine Veg	Marine Veg	None	Benthic Intertidal	Benthic Subtidal	Pelagic	Mainstem Channel	Subsidiary Channel	Channel Edge	Intertidal Flat
Pink Salmon	J F M A M J J A S O N D																			
juveniles	++++*****++----------	X	X	X									X			X	X	X	X	X
adults	--+++**++--	X	X	X		X	X									X	X	X	X	X
Surf Smelt	J F M A M J J A S O N D																			
eggs	****** **********		X	X		X								X						
larvae	+++++++ +++++++++++		X	X		X								X						
juveniles	++++++++++++++++++++++		X	X									X			X	X	X	X	X
spawners	****** **********		X	X		X								X						
adults	++++++++++++++++++++++		X	X									X			X	X	X	X	X
Herring	J F M A M J J A S O N D																			
eggs	**********		X	X							X	X		X	X					X
larvae	**********++++		X	X									X			X	X	X	X	X
juveniles	++++++++**********+++++		X	X									X			X	X	X	X	X
spawners	**********		X	X							X	X		X	X					X
adults	**++++++++++++++++++++*		X	X									X			X	X	X	X	

Fish Habitat Association in Puget Sound (cont.)

Species	Timing	Salinity Range: Tidal Fresh	Salinity Range: Mixing	Salinity Range: Seawater	Substrate Preference: Mud/Silt/Clay	Substrate Preference: Sand/Granule	Substrate Preference: Pebble	Substrate Preference: Cobble	Substrate Preference: Boulder/Riprap	Substrate Preference: Rocky Outcrop	Substrate Preference: Esturine Veg	Substrate Preference: Marine Veg	Substrate Preference: None	Habitats Type: Benthic Intertidal	Habitats Type: Benthic Subtidal	Habitats Type: Pelagic	Habitats Area: Mainstem Channel	Habitats Area: Subsidiary Channel	Habitats Area: Channel Edge	Habitats Area: Intertidal Flat
Longfin Smelt	J F M A M J J A S O N D																			
eggs						X											X			
larvae	-------- ---	X	X	X		X										X	X	X	X	
juveniles	----------------------		X	X									X			X	X	X	X	
adults	-------- ---	X	X	X									X			X	X	X	X	
Anchovy	J F M A M J J A S O N D																			
eggs	--		X	X									X			X				
larvae	----		X	X									X			X	X	X	X	
juveniles	----------------------		X	X									X			X	X	X	X	
spawners	----		X	X									X			X				
adults	----------------------		X	X									X			X	X	X	X	
Sand Lance	J F M A M J J A S O N D																			
eggs	*******++ ++*		X	X		X								X	X	X	X			
larvae	++*********++		X	X		X										X	X			
juveniles	++++++++++******+++++++		X	X		X								X	X	X	X			
spawners	*******++ ++*		X	X		X								X	X	X	X			
adults	----------------------		X	X		X								X	X	X	X			

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Fish Habitat Association in Puget Sound (cont.)

Species	Timing	Salinity Range			Substrate Preference									Habitats						
														Type			Area			
		Tidal Fresh	Mixing	Seawater	Mud/Silt/Clay	Sand/Granule	Pebble	Cobble	Boulder/Riprap	Rocky Outcrop	Estuarine Veg	Marine Veg	None	Benthic Intertidal	Benthic Subtidal	Pelagic	Mainstem Channel	Subsidiary Channel	Channel Edge	Intertidal Flat
English Sole	J F M A M J J A S O N D																			
eggs	****** +			X									X							
larvae	++++**++		X	X	X								X			X	X	X		
juveniles	**********		X	X	X	X					X	X		X	X		X	X	X	X
spawning	++++++++++ +		X	X	X	X									X					
adults	++++++++++		X	X	X	X					X	X			X		X			
Starry Flounder	J F M A M J J A S O N D																			
eggs	--------			X									X			X				
larvae	--------		X	X									X			X	X			
juveniles	--------++++++++++---	X	X	X	X	X					X	X		X	X		X	X	X	X
spawning	--++----			X		X														
adults	++++++++++		X	X	X	X					X	X		X	X		X	X		
Ling Cod	J F M A M J J A S O N D																			
eggs	---------- -			X					X	X				X	X					
larvae	----------		X	X									X			X				
juveniles	----------		X	X	X	X			X	X	X	X		X	X		X	X	X	
spawning	------ -			X					X	X				X	X					
adults	----------			X					X	X		X		X	X					

Fish Habitat Association in Puget Sound (cont.)

Species	Timing	Salinity Range			Substrate Preference									Habitats						
														Type			Area			
		Tidal Fresh	Mixing	Seawater	Mud/Silt/Clay	Sand/Granule	Pebble	Cobble	Boulder/Riprap	Rocky Outcrop	Estuarine Veg	Marine Veg	None	Benthic Intertidal	Benthic Subtidal	Pelagic	Mainstem Channel	Subsidiary Channel	Channel Edge	Intertidal Flat
Shiner Perch	J F M A M J J A S O N D																			
juveniles	++++++******	X	X	X	X	X					X		X		X	X	X	X	X	X
parturition	--++++--		X		X	X					X		X				X	X	X	X
adults	**********		X	X	X	X					X		X		X	X	X	X	X	X
Perch	J F M A M J J A S O N D																			
juveniles	+++******++	X	X	X	X	X					X					X	X	X	X	X
parturition	--+++++--		X	X	X	X					X						X	X	X	X
adults	--++++++++--		X	X	X	X					X					X	X	X	X	X
Pacific Tomcod	J F M A M J J A S O N D																			
larvae	--------		X	X									X				X	X	X	
juveniles	----------++++++++++-		X	X	X	X					X	X			X		X	X	X	
adults	++++++++++++++++++++		X	X	X	X									X		X	X	X	

Shellfish Habitat Association in Puget Sound (cont.)

Species	Timing	Salinity Range			Substrate Preference									Habitats						
														Type			Area			
		Tidal Fresh	Mixing	Seawater	Mud/Silt/Clay	Sand/Granule	Pebble	Cobble	Boulder/Riprap	Rocky Outcrop	Estuarine Veg	Marine Veg	None	Benthic Intertidal	Benthic Subtidal	Pelagic	Mainstem Channel	Subsidiary Channel	Channel Edge	Intertidal Flat
Pacific Gaper Clam	J F M A M J J A S O N D																			
eggs	++++++++++		X	X									X			X	X	X	X	X
larvae	+++++++++++		X	X									X			X	X	X	X	X
juvenile	++++++++++++++++++++++		X	X	X	X								X	X		X	X	X	X
spawning	++++++++++		X	X										X	X		X	X	X	X
adults	++++++++++++++++++++++		X	X	X	X								X	X		X	X	X	X
Horse Clam	J F M A M J J A S O N D																			
eggs	--------												X			X	X	X	X	X
larvae	----------		X	X									X			X	X	X	X	X
juvenile	++++++++++++++++++++++		X	X	X	X								X	X		X	X	X	X
spawning	--------													X	X		X	X	X	X
adults	++++++++++++++++++++++		X	X	X	X								X	X		X	X	X	X
Little Neck Clam	J F M A M J J A S O N D																			
eggs	**********												X			X	X	X	X	X
larvae	**********												X			X	X	X	X	X
juveniles	**********		X	X	X	X	X	X						X	X		X	X	X	X
spawning	**********												X	X	X		X	X	X	X
adults	**********		X	X	X	X	X	X						X	X		X	X	X	X

Shellfish Habitat Association in Puget Sound (cont.)

Species	Timing	Salinity Range			Substrate Preference									Habitats						
														Type			Area			
		Tidal Fresh	Mixing	Seawater	Mud/Silt/Clay	Sand/Granule	Pebble	Cobble	Boulder/Riprap	Rocky Outcrop	Estuarine Veg	Marine Veg	None	Benthic Intertidal	Benthic Subtidal	Pelagic	Mainstem Channel	Subsidiary Channel	Channel Edge	Intertidal Flat
Manila Clam	J F M A M J J A S O N D																			
eggs	**********												X			X	X	X	X	X
larvae	**********		X	X									X			X	X	X	X	X
juveniles	**********		X	X	X	X	X	X						X	X				X	X
spawning	**********												X	X	X				X	X
adults	**********		X	X	X	X	X	X						X	X				X	X
Pacific Oyster	J F M A M J J A S O N D																			
eggs													X			X	X	X	X	X
larvae													X			X	X	X	X	X
juveniles	**********		X	X	X	X	X	X	X	X				X	X		X	X	X	X
adults	**********		X	X	X	X	X	X	X	X				X	X		X	X	X	X
Geoduck Clam	J F M A M J J A S O N D																			
eggs	++++++++		X	X									X			X	X	X	X	X
larvae	++++++++++		X	X									X			X	X	X	X	X
juveniles	++++++++++		X	X	X	X								X	X		X	X	X	X
spawning	++++++++		X	X									X	X	X		X	X	X	X
adults	++++++++++		X	X	X	X								X	X		X	X	X	X

Shellfish Habitat Association in Puget Sound

Species	Timing	Salinity Range			Substrate Preference									Habitats						
														Type			Area			
		Tidal Fresh	Mixing	Seawater	Mud/Silt/Clay	Sand/Granule	Pebble	Cobble	Boulder/Riprap	Rocky Outcrop	Estuarine Veg	Marine Veg	None	Benthic Intertidal	Benthic Subtidal	Pelagic	Mainstem Channel	Subsidiary Channel	Channel Edge	Intertidal Flat
Dungeness Crab	J F M A M J J A S O N D																			
eggs	----------																			
larvae	----------		X	X									X			X	X	X		
juveniles	----------++****++---		X	X	X	X	X				X			X	X		X	X	X	X
mating	------													X	X					
adults	++++++++++++++++++++++		X	X	X	X	X							X	X		X	X	X	
Blue Mussel	J F M A M J J A S O N D																			
eggs	++++*******++++		X	X									X			X	X	X	X	X
larvae	++++*******++++		X	X									X			X	X	X	X	X
juveniles	**********************		X	X				X	X	X				X	X		X	X	X	X
spawning	++++*******++++		X	X									X	X	X		X	X	X	X
adults	**********************		X	X				X	X	X				X	X		X	X	X	X
Softshell Clam	J F M A M J J A S O N D																			
eggs	++++++++++		X	X									X			X	X	X	X	X
larvae	+++++++++++		X	X									X			X	X	X	X	X
juvenile	++++++++++++++++++++++		X	X	X	X								X	X		X	X	X	X
spawning	++++++++++		X	X									X	X	X		X	X	X	X
adults	++++++++++++++++++++++		X	X	X	X								X	X		X	X	X	X